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THE WINGS OF INSECTS.

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CHAPTER III (*Concluded*).

XII. THE VENATION OF THE WINGS OF COLEOPTERA.

The determination of the homology of the wing-veins of the Coleoptera is a difficult problem, owing to the greatly modified structure of the wings. Not only do the wings differ in structure from those of any other order of insects, but the two pairs of wings are modified in different ways. The fore wings, or elytra, have lost their flight-function, and have become thickened protective organs; while the hind wings are, in most cases, transversely folded, which has resulted in a great modification of the courses of the veins and in the formation of secondary vein-like thickenings of the wing.

So different is the structure of the elytra from that usually characteristic of wings that Meinert¹ was led to believe that they were not wings, but greatly enlarged paraptera of the mesothorax; and unfortunately this view was adopted by the senior writer in his *Manual for the Study of Insects*. We have, therefore, two questions before us: first, Are the elytra modified wings, or not? and, second, What are the homologies of the wing-veins?

The reasons in support of Meinert's view are the following: the difference in the structure of elytra from that of wings; the fact that in the Lepidoptera the paraptera of the mesothorax often bear a striking resemblance to elytra (this can be well seen by removing the scales from the paraptera, or patagia, as they are termed, of a sphinx moth); and the fact that in many Coleoptera (*e.g.*, *Dytiscus*) what appear to be rudiments of the fore wings exist beneath the elytra.

The argument based on the thickened structure of the elytra loses its force when we consider the more or less elytra-like

¹ Meinert, F. *Entomologisk Tidskrift*, p. 168. 1880.

wings of many other insects (Heteroptera, certain Blattidæ, *et al.*); and it probably would not have been seriously urged but for the presence of the so-called rudimentary wings beneath the elytra of certain beetles.

When, however, the supposed rudimentary wings are examined, they are found to correspond in structure and position to the alulæ of the wings of other insects. The most conclusive evidence of this correspondence is the fact that they are margined by the cord-like structure which has been termed the

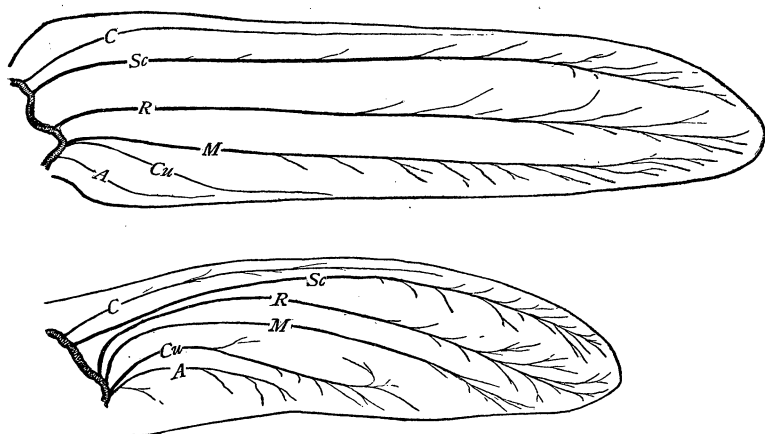


FIG. 50. — The tracheation of the wings of a cerambycid pupa.

spring-vein. This arises from the caudal border of the scutellum, and is a distinctive characteristic of this portion of the wing. The presence of these membranes beneath the elytra, therefore, merely indicates that if the elytra are modified wings they do not correspond to entire wings but to wings minus the alulæ.

When the elytra of a pupa of a beetle are examined, they are found to be traversed by several, usually five or six, longitudinal tracheæ. Although these tracheæ may give rise to a greater or less number of smaller tracheæ, there is nothing in the branching of them, in any of the forms that have as yet fallen under our observation, that corresponds with the branching of the tracheæ in our hypothetical type. But as this is almost as true of the hind wings, it has little bearing on the question of

the homology of the elytra. We are forced to conclude that in this order the wings are so modified that the typical branching of the veins is lost. We have examined, however, a comparatively small series of coleopterous pupæ; and it is quite possible that generalized forms may yet be found in which the typical branching of the veins is preserved.

We refer to the veins instead of to the tracheæ in this connection, as some observations that we have made indicate that in the Coleoptera as in the Hymenoptera the venation of the

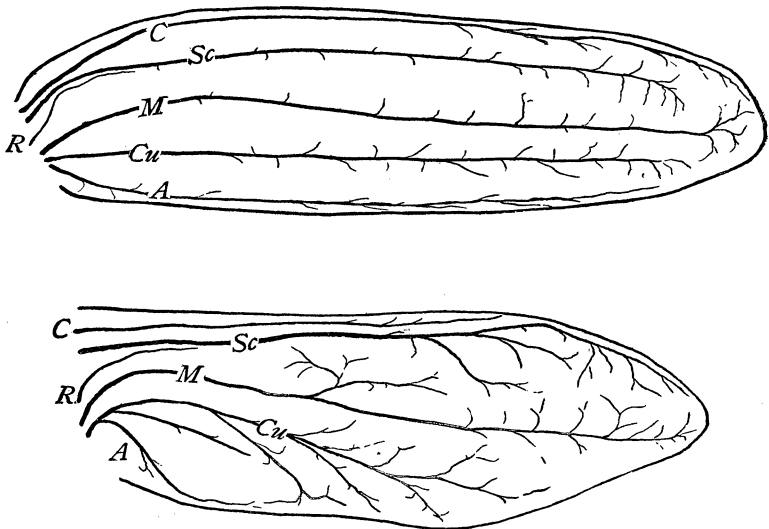


FIG. 51. — The tracheation of the wings of a cerambycid pupa.

wings precede their tracheation, and that the courses of the main tracheæ are determined by the courses of the preëxisting veins.

Returning to the question of the homology of the elytra, the most conclusive evidence that we have found is the fact that a very close correspondence exists between the tracheation of the elytra and that of the hind wings. And what is especially striking is that similar modifications occur in the two pairs of organs.

The accompanying figures of the elytra and wings of two cerambycid pupæ illustrate this point. And the lettering of

these figures will serve to show our conclusions regarding the homologies of the tracheæ.

In the species represented by Fig. 50, the radial trachea is the most prominent one in both elytra and hind wings. On the other hand, in the species represented by Fig. 51, the radial trachea is reduced in both elytra and hind wings to a mere rudiment. If the elytra and hind wings were not homodynamous organs, it is not probable that the modifications of the two would be so closely correlated. We conclude, therefore, that the elytra are modified wings.

In comparing the tracheation of the elytra with that of the hind wings, the most striking difference observed is the greater

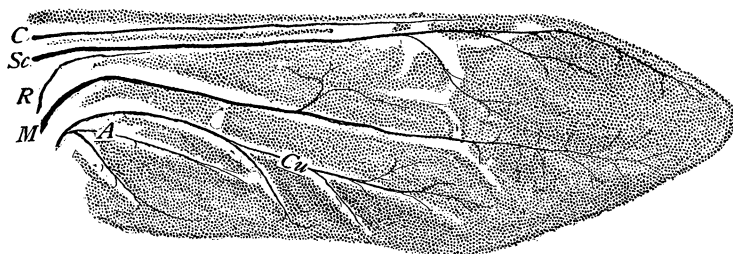


FIG. 52. — Hind wing of a pupa of a beetle.

reduction of the anal area of the former. This is doubtless due to the fact that the meeting of the elytra when at rest in a straight line along the middle of the back does not admit of an expanded anal area.

The extent of the correspondence between the venation and the tracheation of the hind wing of a full-grown pupa is shown by Fig. 52. The principal tracheæ are within the veins, but the branches of these tracheæ extend irregularly through the wing. In the region where the wing is to be folded the secondary vein-like thickenings are only partially supplied with tracheæ.

Although the veins of elytra of adult beetles appear in many cases as well-marked ridges, when elytra of pupæ are prepared, as we prepare wings for this purpose, and examined by transmitted light, we do not find any difference in color between the forming veins and the spaces between them.

With this we conclude our discussion of the venation of the series of forms illustrating the specialization of wings by reduction. The sequence in which the forms have been discussed has been determined merely by convenience, except that we believe that the Plecoptera, which were treated first, resemble the primitive winged insect in the tracheation of their wings more closely than do the members of any other order as a whole. In the next chapter we will give some illustrations of the specialization of wings by addition.

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